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Effect of underlayer on coalescence of silver islands grown by filtered cathodic arc deposition

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Abstract

Ultrathin silver films that are not continuous show relatively high absorption in the visible and low reflection in the infrared. For low-emissivity application on window glass, coalescence of silver islands is crucial for obtaining the desired optical properties of the coating, namely high transparence in the visible and high reflectivity in the infrared. It is well known that the energy of ions arriving at the substrate and the type of underlayer affect nucleation and growth of silver islands. There are a number of studies on nucleation and growth, but little is known about coalescence of silver islands synthesized by more energetic condensation, e.g. filtered cathodic vacuum arc (FCVA). In this work, the effect of underlayer on nucleation and growth of silver films deposited by FCVA was investigated by transmission electron microscopy (TEM) and atomic force microscopy (AFM). The results are compared with data obtained by magnetron sputtering. From the results, plane and titanium-oxide-coated glass requires more material to achieve the same value of resistance than for the zinc oxide coated glass. It is related with the energy of interaction between the surface and the silver atom. Silver films made by cathodic arc deposition show an earlier onset of island coalescence and formation of short links. It was found that silver islands in energetic deposition exhibit a reduced aspect ratio when compared to evaporation and sputtering. Nb underlayer affects nucleation and growth of coalescence of silver only in the case of few monolayer of Nb was introduced.